APPENDIX F

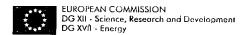
FUEL CELL VEHICLE PROJECTS SUPPORTED BY THE EUROPEAN COMMISSION



THE CONTEXT

- A ten year fuel cell RTD & DEMO strategy for Europe (1995-2005)
- The Action Plan of the Task Force 'Car of Tomorrow' (1996)

1 YOATA-POWERPHI PLICC 1037 PP F - 18 09 1997 - Sade 1



THE STRATEGY GOALS FOR TRANSPORT APPLICATIONS

Qualitative: Cost reduction

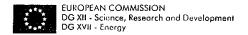
Quantitative: 2005 - Target is

System cost: 200 ECU/kW Lifetime up to 5 000 hrs

◆ Indicative Budget: 160 MECŲ in 10 years from European

Commission (± 10 % of total European

effort)



STRATEGY - TECHNOLOGIES

1. Low cost, low temperature FC

RTD:

- development of advanced SPFC and DMFC systems
- development of fuel cell driven vehicles (buses)
- cheap manufacturing methods for SPFC (up to 100 kW, H₂ and air)

Demo:

- selected applications to show potential of the

technology

D VDATAPOWERPNI PUEC 1097 PPT - 18 09 1997 - Side 16



EU FUNDING THROUGH JOULE PROGRAMME

- ◆ FP3: ± 5,3 MECU
 - 1) Compact reformers (4 projects; ± 1,8 MECU)
 - 2) Integration of a reformer / fuel cell / electric motor (1 project; ± 1,1 MECU)
 - 3) Integration within a vehicle (1 project; \pm 2,4 MECU)
- ◆ FP4: ± 17,4 MECU (until mid 97) .
 - 1) Fuel cell stacks (2 projects; ± 6,3 MECU)
 - 2) Compact reformers (2 projects; \pm 3,2 MECU)
 - 3) Integration within a vehicle (3 projects; \pm 7,9 MECU)

D OATAPOWERPHTVILE C 1097 PPT - 18 09 1997 - Skor

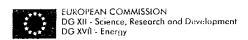


DEVELOPMENT OF FUEL CELL STACKS

(2 projects - FP4)

PROJECT	COORDINATOR	STARTING DATE DURATION	C RATED POWER (kW)	HARACTEF FUEL	NSTICS OF	THE SYS	COST (ECU/kW)	OTHERS	EU FUNDING (MECU)
Second generation SPFC	Siemens AG	1/01/1996 48 months	3,5	H ₂ or purified reformate	air (< 1,5 bar)	60-70	100	emphasis on cost reduction (simplified construction of the cell)	3,5
DMFC: system development and stack construction	Siemens AG	1/01/1996 48 months	1	Me OH	air (< 1,5 bar)	+/- 80	depending on the final application	emphasis on the electrochemistry of the cell	2,8
							:	TOTAL: MECU	6,3

O OATAPONERPHTPUEC (097 PPT - 18 (9 1997 - Sada 7



COMPACT REFORMERS (6 projects in FP3 and FP4)

						TERISTICS SYSTEM	INTEGRATION WITH			e
PROJECT	COORDINATOR	STARTING DATE/ DURATION	FUEL	REFORMING REACTION	RATED POWER (kW)	CO LEVEL TO FC	GCU	FC	VEHICLE MANU- FACTURER INVOLVED	EU FUNDING (MECU)
Hydrogen from methanol for fuel cells	Haldor Topsoe A/S (DK)	1/01/1993 28 months	Me OH	Steam reforming	15-20	-	МО	NO	NO	0,33
Electric battery car with small fuel cells	Fraunhofer Institute Solar Energy Dpt. (DE)	1/02/1993 24 months	CNG	-	20		YES	5 kW	МО	0,37
Methanol reformer for hydrogen production and SPFC feeding	Ansaido Ricerche (IT)	1/02/1993 30 months	Me OH	Steam reforming	50	-	YES	NO	NO.	0,47

D (DATAPOWERPHIT/PUEC 1097 PPT - 18 09 1997 - SAde 8

						TERISTICS SYSTEM	INTEGRATION WITH			
PROJECT	COORDINATOR	STARTING DATE/ DURATION	FUEL	REFORMING REACTION	RATED POWER (kW)	CO LEVEL TO FC	GCU	FC	VEHICLE MANU- FACTURER INVOLVED	EU FUNDING (MECU)
Dynamic response of a methanol reformer for transport	Ansaldo Ricerch e (IT)	1/01/1994 24 months	Ме ОН	Steam reforming		•	YES	Ю	NO	0,6
Integrated methanol reformer and catalytic gas clean-up	Wellman CJB (UK)	1/01/1996 36 months	Me OH	Steam reforming	20	2	YES	NO	ROVER (UK)	1,98
Compact methanol reformer test design construction and operation	Haldor Topsoe A/S (DK)	1/01/1996 36 months	Me OH	Steam reforming	25	< 10	YES	1 kW	NO	1,24
		<u>.,, </u>		<u> </u>			<u> </u>	TOTAL	MECU	4,99

O YOATAPOWERPNI PUEC YORT PPT - 18 09 1997 - Side 9



VEHICLE INTEGRATION (5 projects in FP3 and FP4)

PROJECT	COORDI- NATOR	STARTING DATE DURATION	FUEL	REFOR- MER	RATED POWER (kW)	FC	OTHER POWER SOURCES	VEHICLE	COST TARGET (ECU/kW)	VEHICLE MANU- FACTU- RERS	EU FUNDING (MECU)
Brass-board integration of a reformer / fuet cell / battery / electric motor	ECN (NL)	1/12/1992 36 months	Me OH	-	-	Purchased to Ballard	Battery	NO	-	NO	1,15
Fuel Cell powered EV (FEVER)	Renault (FR)	1/01/1994 47 months	LH ₂	NO	+/- 32	De Nora (IT) (30 kW)	Battery DAUG Ni-Cd (1,8*kW)	Renault Laguna break	-	Renault (FR) Volvo (SE)	2,43
Second generation PEMFC fed with CH ₂ (HYDROGEN)	PSA (FR)	1/01/1996 48 months	CH₂	NO	60	De Nora (IT) (30 kW)	Battery (30 kW)	Citroën Berlingo (small van 5 seats)	200 (stack only)	PSA (FR) Renault (FR)	3,49

DIDATAPOWERPHTPLEC1097 PPT - 18 09 1997 - Shou 1



VEHICLE INTEGRATION (5 projects in FP3 and FP4) (continued)

PROJECT	COORDI- NATOR	STARTING DATE DURATION	FUEL	REFOR- MER	RATED POWER (kW)	FC	OTHER POWER SOURCES	VEHICLE	COST TARGET (ECU/kW)	VEHICLE MANU- FACTU- RERS	EU FUNDING (MECU)
Car autothermal process reactor initiative (CAPRI)	VW (DE)	1/01/1996 48 months	Me OH	Auto- thermal process reactor	5 0	- (15 kW)	Battery NiMH (35 kW)	Golf IV break	-	VW (DE) Volvo (SE)	2,16
Development of full size electric bus with second generation fuel cell stacks (FCBUS)	Ansaldo Ricerche (IT)	1/05/1996 36 months	CH ₂	NO	+1-70	De Nora (IT) (35 kW)	Battery (40 kW)	Neoplan Metro- liner city bus	300	Neoplan (DE)	2,27
	<u> </u>	<u> </u>	<u> </u>	<u> </u>			!		TOTAL:	MECU	11,5

D VIATAPOWER/HITPLEC (097 PPT - 18 09 1967 - Sade 11



CONTENT OF FUTURE RTD& DEMO ACTIVITIES ON FCs

Review of the strategy

Current FCs RTD priorities to be maintained, with the <u>possible</u> following new elements:

TRANSPORT APPLICATIONS

- ◆ IT-SOFC for transport applications (?)
- Safety aspects of FC vehicles (?)
- Evaluation of fuel processing options and comparative assessment of the competing transportation fuels (?)
- Development of opportunities for SPFC bus fleet demonstration?

D IDATAPOWERPHTPUEC1097 PPT - 18 09 1997 - Sade 21